Assessing Forest Resources and Demands

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Reasons for Assessing Forest Resources and Demands

Simply put, the Forest Service assesses supplies and demands for United States' forest resources because we have to. The Secretary of Agriculture is directed by law to prepare "an analysis of present and anticipated uses, demand for, and supply of the renewable resources, with consideration of the international resource situation, and an emphasis of pertinent supply and demand and price relationship trends." And the Forest Service acts as his agent in this assessment.

But more importantly, we see our Agency as custodians of the Nation's renewable resources: outdoor recreation, wildlife and fish, range, timber, and water. Since the mining of mineral resources often has significant effects on renewable natural resources, our analyses also include minerals. Results of periodic assessments are used in developing programs to deal with projected resource situations.

Lead times can be long for programs to have much influence in a resource area such as timber, so projections are made 50 years into the future. The Forest and Rangeland Renewable Resources Planning Act calls for an assessment of the supply-demand situation every 10 years. Plans are now under way for the third assessment due in 1989. The last assessment was done in 1979, with an update in 1984, and contained projections to 2030.

Assessments Analysis

Assessments are done by specialists who concentrate on an assigned renewable resource. The analysis of each specialist is organized around the following points: 1) Analysis of long-term trends, demands, and supplies; 2) social, economic, and environmental implications of trends in demands and supplies; 3) description of the resource base; 4) opportunities to manage and use the resource base to meet the goals of society; and 5) quantification of the major implications of the analysis for the Forest Service's Renewable Resources Planning Act (RPA) Program.

The future is uncertain; projections into the future must rest on assumptions about the effects of selected variables and their interactions on forest resource supplies and demands. Projection methodologies vary among the renewable-resource areas and depend on adequacy of the data available. Especially in the areas of economics and sociology, relationships among variables can change rapidly over time. By contrast, measures of physical relationships such as tree growth change relatively slowly over time.

Various types of research are needed to develop the information required for an assessment of each of the resource areas. There are several ways to classify this research, but it all deals in one way or another with demand and supply.

Demand for Resources

Resource demand can be measured in general ways and in ways specific to a resource area. General measures of demand are population, gross na-

tional product, and personal income. Current expectations are that the U.S. economy will continue to grow, with more people with more money to spend, leading to increased demands for all resources.

Historical data can be used to develop long-term trends in the relationship between consumption and the measures of resource demand. For example, trends in variables such as prices and consumption measure the outcomes of market interactions. They implicitly include the influences of government policies and many other variables and policies. Analysts not only define and describe these trends but also decide whether or not historical relationships will continue into the future.

They can make long-term projections in some renewable-resource areas better than in others, and technical issues also vary from one resource to another. But the overall approach to making these projections is similar for all resource areas. The timber area has the most advanced projection models and data bases.

The RPA assessment calls for an analysis of long-run demands and supplies. Our approach is to use statistics to estimate supply and demand schedules for timber products such as softwood lumber and plywood. For some timber products, analysts evaluate trends in historical consumption and make projections on a judgmental basis. For timber demands, they tie all projections to a few key variables: housing starts, gross national product, population, and personal income. These variables are primary measures of activity in the U.S. economy.

Demands for housing and other end uses of timber products all influence the demand for standing trees. Supplies of standing timber interact with demand to determine prices and output levels. The latter are key indicators of the resource situation. Our analysts must tie together demands and supplies to gain a consistent view of the resource situation. They do this with a mathematical model called the timber assessment market model.

Supply of Timber

The standing timber resource has many characteristics that make it difficult to simulate for long-run projections. Standing timber is a resource in inventory: it can be harvested or left standing from one day to the next.

While the timber is in inventory, it grows, but it may be damaged or killed by fire, insects, and disease. Analysts try to account for the changes to the resource inventory in various ways, the latest being what we call the timber resource inventory model. Data for projecting growth and other measures of the timber inventory are generally based on historical data from periodic surveys done by Forest Service forest inventory and analysis units around the country.

In addition to data on physical attributes, such as growth and mortality, analysts try to account for changes in the area of timber land over time. Timber-growing areas on public lands may be taken out of production for other uses such as wilderness. Private owners of timber land may convert it into cropland or some other use.

Timber sales on public lands are generally set in a prespecified way and are generally predictable. Timber sales from private lands are less predictable, and generally analysts project sales from these lands using relationships derived from historical data.

Characteristics of the timber inventory vary around the country, as do the technical issues of trying to model this inventory. For example, public lands are relatively more important than private lands in determining timber supplies on the West Coast, but the reverse is true in the South.

In the timber assessment market model, there is an attempt to account for interactions among the various supplying and consuming regions in the U.S. timber sector. Our timber situation is heavily influenced by imports from Canada and to a lesser extent by U.S. exports to offshore markets. Analysts also attempt to assess the influence of international markets on the U.S. resource situation.

The first attempt at a comprehensive mathematical simulation model of the U.S. timber sector was completed in the late 1970's. Although a continuing program of trying to improve the various parts of the model has gone on, our experience of the last few years has shown that there is probably no way to develop a definitive model of the U.S. timber sector. Data and insights change over time and influence how we view the workings of the timber economy.

Significant Future Issues

There is no way to tell either whether the model of the future of the forest sector is realistic. The following examples highlight issues that appear to be especially significant in the future for the timber sector.

Housing. The number and size of housing units is especially important in trying to assess future use of softwood lumber, plywood, and other timber products. Reasons for optimism include expectations of a growing population with rising incomes. Reasons cited for pessimism include the potential for high interest rates and high housing costs. Both arguments rest on assumptions about an uncertain future and are therefore not testable.

Technology. People tend to be either optimists or pessimists about technology. If they believe in technology, a future with economic scarcity of timber products is unlikely. Economic scarcity is defined as a situation with rising prices for timber products compared with other products. If they doubt the virtues of technology, the future becomes more uncertain, with economic scarcity a plausible outcome of the current resource situation. An example in the timber sector is the amount of lumber that can be recovered from roundwood logs. As technology has improved over time, more wood in the form of lumber per unit of roundwood processed has been recovered.

State-of-the-art sawmills are efficient in terms of lumber recovery, but most of the industry's capacity consists of mills built over the past 30 years, with wide variation in efficiency. In making projections, analysts must account for the potential effects of technology on the future resource situation.

Forest Management. Especially in the South, the age of harvest for trees is generally less than 50 years—the length of our projection period. Assumptions must be made about what will happen to the land after the trees are harvested. For example, should it be assumed that the timber land will be converted to cropland, should it be assumed that the land will be replanted, or what? In addition, the land may be managed intensively or not at all. What should be assumed? Some historical data on how land is managed exist, but there are both optimists and pessimists about the future who claim that it will be different from the past.

Futures Analysis. Many other examples could be cited as issues in trying to make long-term projections in the forestry sector. Most of these issues cannot be resolved because they deal with uncertainty. The Forest Service has tried to address this

uncertainty through what we call futures analysis, which means we ask a lot of "what if" questions. For example, what if timber management is more intensive in the future than assumed in our projections? What if housing demand is lower in the future than assumed? What if land area available for timber production is less than assumed for the future?

This futures analysis has proven useful in trying to assess the implications of the uncertainties in long-term projections. For example, it has shown that over a wide range of possible futures, the United States faces the prospects of growing economic scarcity of softwood lumber, with continuing increases in prices.

The uncertainties discussed for projections of demands and supplies also are involved in trying to assess the social, economic, and environmental implications of trends in demands and supplies. For example, what will society consider important 50 years from now?

Research Opportunities to Improve Projected Resource Situation

Previous assessments provide indications of the present and prospective supply-demand situations for the various renewable resources. They also provide indications of opportunities to change the expected resource situation. A review of these situations and opportunities to change them is useful in pointing out the directions needed for data bases and analysis methods in the future.

Timber. Comparing available projections of future timber supplies with timber demands makes it clear that a physical shortage of timber in the United States in the decades immediately ahead is not likely. Demands are rising faster than supplies, however, so that the outlook is one of increasing economic scarcity with rising timber and timber-product prices.

Higher prices for timber products have many implications for the U.S. economy. Higher prices for softwood lumber and plywood would raise the cost of housing and reduce both the number and size of houses. Relatively higher prices for timber products would lead to increased use of substitutes such as concrete, steel, aluminum, and plastic. The mining, industrial processing, and power generation associated with increased use of timber substitutes would result in more air and water pollution. Rising prices would also affect the timber resource. Owners of the resource would increase harvests as prices go up; and as harvests rise, net annual growth and inventories would be changed.

Three major ways to respond to rising demands for timber are: (1) Extending supplies through improved utilization, (2) increasing harvests from the existing timber resource, and (3) increasing net annual growth.

Timber supplies can be extended by:

- Increasing the useful life of wood products by preservative treatments; improving designs of new structures, and fixing existing structures rather than replacing them.
- Improving efficiency in harvesting, construction, and manufacturing.
- Utilizing unused wood materials such as logging residues.

Harvests from the existing timber resource can be increased by:

- Accelerating harvests on National Forests in Washington, Oregon, northern California, northern Idaho, and western Montana that have large inventories of old-growth softwood timber.
- Increasing softwood and hardwood timber harvests on forests in the East.

Sustaining increased harvests on the National Forests in the West and on the forest lands in the East beyond a few decades will require large investments in more intensive management programs to increase net annual timber growth.

Net annual timber growth can be increased by:

- Regenerating nonstocked and poorly stocked commercial timberlands, harvesting and regenerating mature stands, and converting existing stands to more desired species.
- Applying intensive timber management practices such as species and spacing regulation, fertilization, and use of genetically improved trees.
- Using management and harvesting practices to prevent or reduce losses caused by natural mortality, undesirable vegetation, wildfire, insects, diseases, and poor logging practices.

Water. Precipitation provides enough surface and ground water to meet prospective demands for water in the United States; however, serious imbalances are caused by geographic, seasonal, and annual variation in supplies. The location of agriculture is especially sensitive to the availability of water for irrigation. In some places (e.g., the areas on the High Plains of Texas and adjoining States where ground-water mining for irrigation is severe), as water production costs go up and the water for crop and pasture land irrigation becomes uneconomic, there will be a shift to dryland farming or range grazing. Food and fiber production will be reduced in the affected areas; eventually production will move to regions where water supplies are adequate and the land is suitable for crop and pasture use.

Most of the prime farmland that is not now in crops or pastures is in forest and range. If production is shifted from irrigated areas in water-short regions, these lands are most likely to be converted to crop and pasture use. The conversion of these highly productive lands will reduce timber and forage production.

Flooding and water pollution are other significant costs associated with the prospective supply-demand situation for water.

Many opportunities exist on forest and range lands to increase and extend water supplies, ameliorate the effects of flooding, and improve water quality. All these things can be achieved by:

- Improving vegetation management to increase the natural recharge of surface and ground water, to reduce evaporation losses, and to change the timing of waterflows.
- Improving protection of watersheds from wildfire.
- Maintaining wetlands.

Water supplies can be increased or extended by:

- Expanding and improving reservoirs to increase storage, regulate flows, and reduce evaporation.
- Improving snow management.
- Improving conservation, including more re-use.

Flood damage can be reduced by:

- Controlling floatable debris such as logging residues.
- Increasing use of structures to control waterflows.
- Improving management of flood plain use.
- Expanding land treatment programs.

Water quality can be improved by:

- Improving use of pesticides and fertilizers.
- Increasing reclamation of mine sites to reduce erosion and acid flows from abandoned mines.
- Improving poor watershed conditions.

Tree shearers clip off even large trees like this pine at ground level.

Range Forage. The demand for range forage depends primarily on the demand for red meat and the availability of substitute feed sources such as grain. There is some uncertainty about future per-capita consumption of red meat; however, even if per-capita consumption does not increase, total demand will grow because population will grow. Available data indicate that the amount of range forage used by domestic livestock annually has remained unchanged at 200 million animal unit months per year for the past several decades. Increases in demands for red meat would place increased demands on rangeland.

The opportunities to increase forage production and to improve the condition of forest and range land for grazing include:

- Improving rangelands by seeding better grasses and legumes and controlling noxious weeds and other undesirable plants and shrubs.
- Increasing the use of forage on forest and range lands by the use of improved grazing systems and livestock management practices.
- Constructing needed livestock control and handling facilities such as fences, and developing adequate water supplies.
- Reducing forage losses by controlling wildfires, range insects and diseases, and pests.

Outdoor Recreation and Wilderness. In the last two decades participation in most kinds of outdoor recreation has been growing, and this growth is expected to continue. The supplies of outdoor recreation facilities now available will have to be expanded if the projected growth in demand is to be met and quality maintained. New trails and campgrounds will have to be built, and meeting the prospective growth in demand for some activities, such as winter sports facilities, will require special efforts.

Most of the projected increases in demands for outdoor recreation on forest and range lands and inland waters can be met. The major opportunities include:

- Rehabilitating deteriorating sites and adequately maintaining existing facilities.
- Constructing additional facilities such as trails, campgrounds picnic areas, and boat ramps.
- Designating additional areas as wilderness, where appropriate potential exists.
- Improving access to forest and range land and inland water suitable for outdoor recreation.
- Expanding programs concerned with visitor information services including educational services and back-country safety patrols.
- Improving management and information techniques for shifting more recreation demands to underutilized areas and facilities.
- Improving the coordination and integration of outdoor uses with other uses.
- Improving management and protection practices to minimize the adverse impacts on wilderness resources.

Wildlife and Fish. Although there are indications that the populations of some wildlife and fish species have been increasing, there also are indications that they have not been rising as rapidly as demands. For example, the number of big-game animals per hunter has been dropping rapidly in most regions. Demands on the wildlife and fish resource are likely to continue to grow in the future.

Opportunities to respond to the diverse demands on the wildlife and fish resource include:

- Expanding programs to improve wildlife and fish habitats by increasing food supplies and suitable habitat cover, improving water quality, and increasing the size, di-

versity, and distribution of habitat areas.
- Integrating more fully wildlife and fish needs in the management of forest and range lands for other renewable resources, and especially timber and forage.
- Providing better access by constructing trails, boat landings, and rights-of-way where the wildlife and fish resources are underutilized.
- Controlling land and water pollution, and especially the use of pesticides that adversely affect wildlife and fish species.
- Expanding wetlands nesting habitats through fee purchase of key tracts and easements in the United States and Canada, and preserving and enhancing migration and wintering habitats.
- Increasing the reintroduction of species that have been displaced in areas where suitable habitats exist or can be developed.

In addition, there are some opportunities that relate to specific demands on the wildlife and fish resource. These include:
- Increasing efforts to define, protect, improve, and increase critical habitats of endangered and threatened species and the important habitat of other species being adversely affected by changes in management or use.
- Removing barriers to fish migration.
- Promoting the nonconsumptive use of fishery resources in some select areas through special management techniques such as catch and release fishing.

Minerals. The growing U.S. economy will lead to more demands for all kinds of minerals in the future. Some of this increase in demand will be met with imports, but a large proportion will be met from domestic sources. This is especially the case for coal, where there may be as much as a tenfold increase in production by 2030. A tenfold increase in coal production would involve mining large areas of rangelands in Wyoming, North Dakota, and Montana, as well as in other Midwestern and Eastern States. Nearly all of the land disturbed by mining will undoubtedly be reclaimed, but the effects of the disturbance on such activities as production of timber and wildlife habitat can extend over decades.

The impacts of the projected growth in mining on the environment and renewable resources can be managed by:
- Increasing research to develop more efficient and economical ways of reclaiming disturbed land.
- Expanding programs to control mine-related pollution and to reclaim disturbed areas.
- Using appropriate lease and operating stipulations to control environmental impacts.

Future Research Needs

The management opportunities already described can be carried out with existing technology—the knowledge base that has been developed through past research work. Further research can, however, develop new ways to increase and extend supplies of renewable resources and reduce the cost of implementing these opportunities for all resources—timber, water, forage, outdoor recreation, wildlife and fish, and minerals.

For example, research to develop genetically improved plant and animal species, more economical ways of regenerating or propagating desired species, and methods for controlling unwanted species, insects, diseases, and wildfires can contribute to the effectiveness of management practices. Research on better ways of restoring and protecting watersheds and of reducing the adverse effects of activities

such as timber harvesting and mining can increase waterflows, reduce flooding, and improve water quality and wildlife and fish habitat. Because of the environmental and biological effects of chemicals, there is a special urgency for research to develop management practices based on natural control measures for reducing the impacts of undesirable vegetation, insects, diseases, and pests.

These are the classic kinds of research opportunities and undoubtedly the ones that can contribute most to meeting future demands on renewable resources. However, there are other research needs. For example, inventories of forest, range, and water resources are basic to almost any decision concerning the management or use of these resources. Presently, inventory information is fragmentary and limited for most resources—and especially so for range, wildlife and fish, outdoor recreation, and minerals.

In many respects, information on the production from, and the uses of, forest and range lands and waters is more fragmentary and limited than that for inventories. National and regional data on the amount of range grazing, many end uses of timber products, recreational activities by kinds, and wildlife harvests are largely nonexistent. Further, lack of comparability and timing severely constrain the usefulness of part of the data that are collected.

Systematic, continuing surveys with national standards and specifications on the data to be collected could greatly help analyses of investment opportunities, the effectiveness of existing policies and programs, and new or additional management and program needs.

More information is needed on the physical responses of forest and range lands and waters to changes in management practices in terms of changes in timber and forage growth, water yields, and wildlife populations. There is an equal need for information on the costs of management practices and on the prices and values of renewable resource products and uses. Such information is essential for evaluating investment programs, analyzing supply situations, and determining harvest and use levels. It also is essential for the management of lands and waters for multiple purposes and for minimizing adverse impacts on the natural environment.

Finally, research is needed to explore further the social, economic, and environmental implications of a future in which the demands for renewable-resource products are rising more rapidly than supplies. Such research is concerned with the societal basis for changing policies and programs. The results are likely to have profound impacts on management and use of forest, range, and water resources.